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## **The Linkages of Energy and Water**

### **The Case of the Ili-Balkhash Basin**

Diplomityö, joka on jätetty opinnäytteenä tarkastettavaksi  
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## Tiivistelmä

Viime vuosisatojen aikana maailman hyvinvointi ja kansainväliset suhteet ovat laajalti edistyneet energiatuotannon resurssien ja teknologian vaikutuksesta. Energiatuotanto ja vesiresurssien hallinta ovat usein toisistaan riippuvaisia ja viime vuosikymmenien tehostetun energiatuotannon jäljiltä monet alueet kärsivät nyt vesipulasta ja maailmanlaajuisesti fossiilipolttoaineresurssit vähenevät entisestään. Koska energia ja vesi ovat niin tiiviissä vuorovaikutussuhteessa ja vaikuttavat meidän hyvinvointiimme sekä globaaliin suhteisiimme, on ratkaisevaa ymmärtää tätä vuorovaikutussuhdetta paremmin. Tässä työssä tutkin tätä suhdetta tarkastelemalla miten nykyinen energiakauppa Kiinan ja Kazakstanin välillä vaikuttaa rajanylittävään Ili-Balkhash valuma-alueeseen ja miten suunniteltu synteettisen luonnonkaasun tuotanto alueella voi vaikuttaa sekä valuma-alueeseen että valtioiden välisiin suhteisiin.

Tässä työssä päättelen että näiden kahden valtion välinen energiakauppa ruokkii väestönkasvua, maahanmuuttoa sekä kulutusta alueella. Tämä kehitys lisää sekä vedenkäyttöä että saastumista tarkastetussa valuma-alueessa. Kauppakumppanuus dominoi valtioiden välistä suhdetta, ja tämä asetelma ei anna tilaa vesiproblematiikan keskusteluun. Tulen myös johtopäätökseen että synteettisen luonnonkaasun tuotanto alueella tulee kuluttamaan Ili-Balkhash valuma-alueen vesiresursseja entisestään ja voi toimia merkittävänä ympäristöongelmia generoivana tekijänä. Tämä uusi energiatuotannon menetelmä tulee vähentämään Kiinan riippuvaisuutta Kazakstanin energiakaupasta ja tämä voi vuorostaan avata valtioiden suhdetta siten että ne pystyisivät keskustelemaan vesiresursseja koskevista kysymyksistä.

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**Avainsanat** Vesiresurssit, energiakauppa, energiatuotanto, vesivaje, Keski-Aasia

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## **Abstract**

For the past couple of centuries global affluence and relations have largely been driven by the resources and methods of energy production. Energy production and water resources management are often decidedly dependent on one another and after the intensified energy production of the past decades many regions now find themselves water scarce and many fossil fuel resources are dwindling globally. As energy and water are so closely interlinked and affect our wealth and our global relationships, it is crucial that we understand their linkage better. In this thesis I will examine that linkage by studying how the current energy trade between the P.D.R. China and Kazakhstan affects the transboundary Ili-Balkhash watershed indirectly and how the planned synthetic natural gas development in the region can affect both the watershed and the existing relation between the countries.

In the study I conclude that the energy trade between the two states fuels population increase, immigration and consumption in the region. This development increases both water use and pollution of the watersheds in the studied watershed. The trade partnership creates a relationship between the states, which leaves no room for discussion of these issues. I also conclude that the production of synthetic natural gas in the region will deplete the Ili-Balkhash watershed further and it can act as a major source of pollution of the watershed. This new form of energy production will also lessen China's dependency on Kazakhstan for energy trade and this can free up their relations to such a level that discussions regarding water resources can be possible again.

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**Keywords** Water resources, energy trade, energy production, water stress, Central Asia

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## Foreword

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# 1 Introduction

Energy production and water resources management are in a great many cases closely dependent on each other, whether the method of choice is hydropower, coal, oil, gas or any other one. With the insecurity facing the fossil fuel supply around the world, alternative methods of power productions are being developed. Simultaneously there are global concerns of rising temperatures due to greenhouse gases as well as more local fears of water scarcity and the method and intensity of energy production plays a major part in solving both issues. The world has already for decades been in a situation where economic affluence and global relations have been largely driven by the resources and methods of energy production. Now we are facing a time where the availability and management of water resources plays a similar role. Energy and water are two of the main sources of wealth, and keepers of peace, on the planet and they are closely inter-linked. This study will aim to present a part of that linkage through examining the following case.

In a region largely relying on its energy production to attain economic growth (Dorian et al., 1997a), Kazakhstan is enjoying more visibility than ever before (Hug and Zhang, 2010). Large findings of natural gas, coal and especially oil fuel the economy of the nation, Kazakhstan being the wealthiest among Central Asian nations by quite some margin (Dorian, 2006). Along Kazakhstan's eastern border lies the Chinese state of Xinjiang, also known as the Xinjiang Uygur Autonomous Region. The ethnically diverse state plays an important role in Chinese economy through, among other factors, its energy resources, including coal, oil and natural gas (Malhotra, 2013) as well as its ties with Central Asia (Clarke, 2011).

The economic and political ties between the Central Asian Republics (CARs) and China are developing with exceptional intensity (Dodonov, 2010) and China is today the number one economic actor and main source of foreign investment in the five states (Mariani, 2013). The Chinese interest in Kazakh energy export is one of the key drivers of this development (Saurbek, 2008), but also other reasons play a role. The tightening of ties between China and Central Asia provides China with relief in its long-playing secu-



rity issues in Xinjiang as well as a means with which to integrate Xinjiang with the Chinese heartland (Clarke, 2011). Simultaneously Central Asia is strategically becoming more important and both external and internal actors are pursuing power in the region, acting as yet another incentive for intensified Chinese – Kazakh relations (Blank, 2012, Clarke, 2011).

This relationship is now being tried due to the nature of energy flowing in one direction and water flowing in the opposite. Some of Kazakhstan's largest rivers and most valuable water resources enter the country through Xinjiang, one of the largest being the Ili river (Houshower, 2009). The Ili river is heavily utilized upstream of the border in Xinjiang, to such an extent that water depletion poses a problem along its course in Kazakhstan (Sievers, 2001). Rapid development and immigration from the Chinese heartlands to Xinjiang will put further pressure on this resource in the future (Allouche, 2007). The terminus of the Ili river lies in Lake Balkhash (Yedilbayev and Shokanova, 2012), a lake now in danger of facing the same fate as its well-known neighbor, the Aral Sea (Allouche, 2007). Loose agreements do exist to control trans-boundary water management between the two constituents (Allouche, 2007) but such are the relations between the countries that Kazakhstan has chosen not to take an aggressive stance in the matter (Sievers, 2001).

Due to its significant and affordable reserves of coal, Xinjiang is a centre in the development of synthetic natural gas, or SNG, in China (Huo et al., 2013). The SNG project was commissioned in China because of the high demand and its insufficient resources of natural gas (Li et al., 2014). In the production of SNG coal, and in some cases biomass, is gasified and then converted to methane, the main component of natural gas (Chandel and Williams, 2009). Among the positive effects of an SNG-industry are a lesser dependency on fossil fuel imports, an opportunity to cut down on greenhouse gas emissions and larger global reserves as well as a longer expected availability of the raw material (Kopyscinski et al., 2010), especially the first two are seen as important issues in contemporary China (Ding et al., 2013). SNG production is extremely water intensive and the development of the SNG-industry in Xinjiang will result in less available water both in the state itself as well as in downstream Kazakhstan (Huo et al., 2013). Moreover, the production process results in significant amounts of pollution in the form of wastewater and water residue (Huo et al., 2013).

In this article I want to investigate two parallel relationships, that between the politics of energy and water as well as that between the states of Kazakhstan and China. To understand these issues further I wish to answer two questions that merely have been broached in earlier studies. How does the oil trade, and resulting relationship, between Kazakhstan and China (Xinjiang) indirectly affect the water resources in the area? And what effects will the emerging SNG technology in Xinjiang have on the relations between the two countries and their respective water resources? These questions are important to answer in order to foresee the environmental challenges faced in this rapidly developing area and to prevent an environmental disaster, but there is also a less obvious reason for asking these questions. The relationship between the two states is largely dependent on the flows of energy and water and answering these two questions is therefore crucial in the understanding of future power relations and the political stability of Central Asia.

I have chosen the Ili-Balkhash system as a geographical frame to review these questions. This is due to the central role of the Ili-Balkhash as a water resource both in Xinjiang and in Kazakhstan as well as the watershed being chosen as the main area of development of SNG production in Xinjiang. This study is conducted as a literary review of material covering energy policy, environmental and water resources issues in Kazakhstan and China (Xinjiang) as well as relations between the two states.

## 2 Relations

In this chapter, I will investigate the relationship between China and Kazakhstan. I will look at how their ties became so strong, what their current relationship looks like and why energy trade plays such a big part on their common agenda.

China's interest in relations with the Central Asian republics is partly founded in the battling of separatism in Xinjiang and the shared geographic vicinity, religion and ethnicity between the CARs and the Uighurs of Xinjiang (Dorian et al., 1997b). Ethnic inequality between privileged Han-migrants and the indigenous Uighur population has sparked tension over the past decades (Wu and Song, 2014) and the Chinese government fears Uighur separatism, terrorist attacks and Islamic radicalism (Millward, 2004). China is continuously encouraging the relocation of millions of Han Chinese to Xinjiang. This massive immigration has created further tension between the ethnic groups in Xinjiang (Howell and Fan, 2011). It has also led to a rapidly growing need of food and labour which in its turn takes a toll on the water resources of the arid state (Sievers, 2002).

Concern of security was one of the main reasons for China to instigate the Shanghai Cooperation Organization (SCO) in 2001 (Ong, 2005) together with Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Russia (Aris, 2009). The SCO has grown into an organization that also tackles economic and cultural exchange and the Chinese government is using this platform to gain influence in Central Asia (Ong, 2005), especially Kazakhstan (Steiner, 2013). With the developing and opening up of Central Asian markets (Fedorenko, 2013) and the withdrawal of US troops from the region in 2014 (Mankoff and Kuchins, 2013) the great powers of the world are now competing for influence and economic power among the republics (Kim and Indeo, 2013). This "New Great Game" of Central Asia also brings an unprecedented opportunity for the Central Asian republics themselves in tapping into international markets, improving infrastructure and ensuring domestic security as these deals help the more or less totalitarian regimes of the Central Asian republics to stay in power (Blank, 2012).

After the breakup of the Soviet Union, Russia's role as the leading outside power of the region has weakened considerably (Spechler and Spechler, 2013) while the US launched its "New Silk Road" strategy as a plan to sustain regional security after the withdrawal

of US troops from Afghanistan in 2014 (Kim and Indeo, 2013). The US government realizes that China and Russia (and possibly India) will retain most influence in the region and that the role of the US should be to knit together regional security and cooperation arrangements (Mankoff and Kuchins, 2013) so as to simultaneously counteract Islamic militancy and lessen the CARs dependence on either Russia or China (Kim and Indeo, 2013).

China on the other hand is gaining the upper hand among the two great foreign powers of Central Asia, pushing Russia aside into a less influential position (Blank, 2012). China is not only a significant trade partner among the CARs but also an influential one and the authoritative regimes of the republics largely see China as a guarantor for staying in power (Kim and Indeo, 2013). Large quantities of energy are needed to fuel the rapid development of China (Lai, 2002) and securing this resource from right across the border coincides with China's interests of regional dominance and stability (Clarke, 2011). Kazakhstan is not only in this partnership for the economical profits gained from the energy trade and a complex cooperation has emerged with China, including also geopolitical interests and political collaboration (Saurbek, 2008).

Both the production and use of energy in Kazakhstan is dominated by fossil fuels (Dulambayeva et al., 2013). Kazakhstan is among the world's leading oil producers (Palazuelos and Fernández, 2012) and its neighbour China is the second largest oil consuming country in the world (Saurbek, 2008). According to the Kazakhstan Chamber of Commerce (2011), China is now the leading export partner of the country with a share of 17.1% of all Kazakh exports. The value of this trade is expected to grow steeply over the upcoming years (ING Financial Services, 2012) with oil constituting 60% of the revenue. The main pipeline between Kazakhstan and China was China's first transnational oil-pipeline in 2006 and recently expanded in 2013. It is considered for further expansion pending the development of new oilfields in Kazakhstan. Oil import from Kazakhstan is only expected to rise in China in the future but simultaneously China is developing the production of Synthetic Natural Gas (SNG) from coal. The major part of this production is planned to take place in Xinjiang and will be presented later in this article (U.S. energy information administration, 2015). Currently the coal industry is underdeveloped in Xinjiang and the coal industry is cited as the biggest projected provider

of new jobs in the near future with the SNG production industry being the main employer (Xiao et al., 2014).

Kazakhstan's economic success is dependent on the flow and demand of oil (Palazuelos and Fernández, 2012). Trade is not the only reason Kazakhstan sees good relations with China as essential. Border security and the political and economic model of China as a centralized state is to the liking of the Kazakh government (Hug and Zhang, 2010). With Russian power dwindling (Blank, 2012) and the West hit by recession and keen on seeing political reform in Kazakhstan (Hug and Zhang, 2010), China is seen as an attractive and greatly influential partner by Kazakhstan (Blank, 2005). In the upcoming chapter I wish to research how these strong relations affect the trans-boundary water resources between Kazakhstan and China.

### 3 Water – How Kazakh Chinese relations influence water resources

The Ili has its origin in the Tien Shan of central Xinjiang, the mountains gathering the moisture entering Xinjiang and ensuring a precipitation in the eastern Ili Valley that is about seven times greater than that of Xinjiang as a whole (Shen et al., 2013). Almost all of the water of the Ili originates in Xinjiang (Sievers, 2001), from both rainfall and glacial melting in the Tien Shan (Kezer and Matsuyama, 2006). The river is mainly used for the irrigation of agriculture, especially in Xinjiang (Stone, 2012) and has been utilized already for decades by the Soviet, Chinese and Kazakh people to such an extent that water supply issues and pollution are well known issues along its course (Sievers, 2001). Due to the low precipitation and a high estimated evaporation the river serves as the main source of water for a large number of the local inhabitants on both sides of the border (Zuo et al., 2013).



**Figure 1: The Ili River, Lake Balkhash and their positions within Kazakhstan and Xinjiang, China (Del Pietro, 2007)**

The Ili river empties into lake Balkhash and provides a great majority of the water flow into the lake (Kezer and Matsuyama, 2006). Lake Balkhash located in Southeaster Kazakhstan is one of Central Asia's largest closed inland basins (UNDP, 2004). The water resources of the lake are mostly used for irrigation, industry and water supply and in addition to this Balkhash supports one of the most important fisheries of Kazakhstan

(Kezer and Matsuyama, 2006). The water balance of the lake mostly depends on the inflow and evaporation and due to this context the lake has suffered from declining water levels and pollution already for decades as the Ili River has been increasingly utilized and polluted (UNDP, 2004).

Xinjiang is one of the most water-stressed regions in the world (Shen et al., 2013) and water constraint is considered to be the main hindrance for development as the correlation between water consumption and per capita GDP is high by Zuo et al. (2013). Water infrastructure and irrigation is one of the principal areas of development in China's Western Development Program (Lai, 2002) and the coordination of water use is the primary focus of Xinjiang's Leapfrog Development of the 12<sup>th</sup> five year plan, laying a foundation for further socio-economic development (Zuo et al., 2013). As the development of the state is partly driven through the encouragement of immigration, water demand is on the rise (Sievers, 2002). Irrigation stands for over 90% of the water consumption in Xinjiang but water consumption in manufacture and construction is expected to almost double between 2010 and 2020 (Zuo et al., 2013).

Water diversion from the Ili River in Xinjiang is already lowering the water level of the river across the border in Kazakhstan and is a major concern in a large part of the country (Stone, 2012). The diversion is expected to increase over the upcoming years (Mustafina, 2014). Climate change is expected to bring more precipitation to the Ili basin but glacial melting in the Tien Shan Mountains would simultaneously diminish the discharge over time, resulting in a natural discharge lesser than at present (Stone, 2012). The possible increase of diversion of water from the Ili River on the Chinese side of the border is considered a national security risk by the Kazakh government and this issue may become one of the most critical issues in the relationship between the states (UNDP, 2004). An earlier example of this is the Chinese diversion of the Irtysh River's water for the Black Irtysh – Karamay canal (Mustafina, 2014). This canal diverts roughly half of the water of the Irtysh on the Xinjiang side of the border. Yet China did not notify Kazakhstan nor Russia, as downstream riparian countries, of the building of this canal before its completion (Sievers, 2002).

To date China has not signed any international treaty on the use of trans-boundary rivers (Mustafina, 2014). The strengthening of relations between China and Kazakhstan both

when it comes to trade and security and the Chinese Western Development Program do not go hand in hand with Chinese intentions in its water-policy with Kazakhstan (Sievers, 2001). In 2001 the two states signed “an agreement to facilitate cooperation on trans-boundary water management including the Ili” (Allouche, 2007). The states have held regular meetings on the theme but so far there has been no agreement on yearly water allocations. Kazakhstan proposed selling heavily subsidized food to China in exchange of a commitment of an unimpeded flow of the Ili on the Chinese side. China turned down this proposal (Allouche, 2007). Kazakhstan has chosen not to aggressively confront China on matters regarding the use of water resources. The risk of these diversions is both an inter-state conflict and a domestic one within Kazakhstan, due to a potential feeling of negligence perceived by the affected population in regards to the government (Sievers, 2001). The Kazakh government has recognized water stress as one of the most pressing questions of national security (UNDP, 2004).



## 4 Synthetic Natural Gas Production in Xinjiang

As energy demands are steadily rising all over the world the reserves of our traditional sources of energy, oil and natural gas, are dwindling (Kopyscinski et al., 2010). Alternative methods and sources for energy production are being considered as a result and synthetic natural gas (SNG), a method that has been off the table for decades, is now becoming economically viable again (Chandel and Williams, 2009). There are several commercial SNG projects around the world under various stages of development, some of the biggest ones being located in Xinjiang. SNG can be produced from two different raw materials of quite different character, coal and biomass (Kopyscinski et al., 2010). The use of biomass, as a carbon neutral fuel, in the production of SNG makes it an energy technology reasonably low on greenhouse gas emissions (Chandel and Williams, 2009). In this chapter we will however examine the production of SNG from coal as this is the method relevant for our geographical area.

Synthetic natural gas production from coal also has many obvious upsides. The SNG production process from coal is capable of achieving low levels of sulphur, mercury and nitrogen oxide emissions if the by-products are treated accordingly (Chandel and Williams, 2009). Available coal reserves are expected to last for another 150 years compared with the reserves of oil and natural gas which are predicted to be used up within the next 40 – 60 years (Kopyscinski et al., 2010). Coal is also more evenly distributed on the surface of our planet compared with oil and natural gas. The development of SNG production from coal would therefore increase energy security and help in stabilizing the global fuel market (Chandel and Williams, 2009).

To the cons of SNG production from coal can be counted the emissions of CO<sub>2</sub>, which are larger than those of the direct use of either coal or natural gas as a fuel. This is due to the production process where coal is refined to SNG (Chandel and Williams, 2009). Life cycle CO<sub>2</sub> emissions are considerably higher than “all competitive pathways” (Ding et al., 2013). The economic viability of SNG production is dependent on several volatile factors, such as the price of not only coal but also all other raw materials and technologies used to produce energy, the price of energy and politics regarding CO<sub>2</sub> emissions as well as the possible use and price for CO<sub>2</sub> harvested in the process (Chandel and Williams, 2009). Another notable con of SNG production is its water intensity (Huo et al., 2013) which we will return to later in this chapter.

The commercial process of producing synthetic natural gas from a solid carbon source starts with the gasification of the coal using steam and oxygen (Kopyscinski et al., 2010). The result is a mixture of a number of gases called syngas (Chandel and Williams, 2009). The syngas needs to be cleaned of impurities and after that it is conditioned into the form that is most useful for its purpose, e.g. fuel production. Conditioning of the syngas is achieved through a step called the water-gas shift reaction. In the water-gas shift reaction CO and H<sub>2</sub>O are converted into CO<sub>2</sub> and H<sub>2</sub> (Kopyscinski et al., 2010). After this the conditioned syngas goes through the methanation process where CH<sub>4</sub>, methane, is produced in a fixed-bed catalytic reactor while steam is added to reduce coke formation. This is now the finished SNG product that is ready for use as a fuel in power plants or transportation. There are two alternative processes of converting coal into SNG and more are being developed and researched but this process is the only one currently in commercial use (Chandel and Williams, 2009).

China has for decades been struggling with urban airborne pollution, a phenomenon that can largely be explained by rapidly increasing energy demand, the dependency on electricity production from coal and a growing pool of vehicles (He et al., 2002). To alleviate this serious hazard to health and environment the Chinese government has efficiently promoted the use of natural gas and renewable sources in energy production. In 2012 natural gas was the source for 5.3 % of consumed energy in China with a steady yearly increase. China signed trade partnerships in 2012 with a number of countries, including Kazakhstan, to meet the demand of natural gas (Li et al., 2014). China's own resources of natural gas are very limited while about one third of global coal resources are located in the country (Huo et al., 2013).

In 2013 the Chinese government initiated a strong support of the production of SNG from domestic coal resources (Yang, 2015). According to Ding et al. (2013) there are 30 major SNG projects under development or planning in China and the projects in Xinjiang would stand for about 64 %, of the total production (Ding et al., 2013). Xinjiang has been chosen as the major centre of China's SNG development as it has almost half of the nations coal resources. The development of SNG production in Xinjiang will lessen China's dependence on foreign fuel imports (Yang, 2015).

The production of SNG from coal puts pressure on the environment in two major ways, by using water and by polluting the environment. The process of producing one ton of SNG from coal consumes about 6-7 tons of water (Huo et al., 2013). With a planned yearly production of 77 billion m<sup>3</sup> of SNG in Xinjiang, the pressure on the local water resources would be on a scale of  $3.23 - 4.85 \times 10^8 \text{ m}^3$ , representing around 0.5 – 1% of the yearly consumption of water in Xinjiang. The only region of Xinjiang with both adequate water and coal resources for the production of SNG is the Ili basin. This concentrates the effects on the environment of SNG production on a limited geographical scale, that never the less spans two countries. Pollution is by some experts (Huo et al., 2013) seen as an even more severe challenge for the environment. Waste “such as chemical and biological sludge and phenol containing wastewater” (Huo et al., 2013) are a result of the SNG production process and according to studies conducted in the Ili region, the enterprises are not being sufficiently rigorous with environmental protection.

## 5 Discussion

The Chinese plans of SNG production have the possibility to make a large impact on many levels, not just in the producing centre of Xinjiang but also further afield in Kazakhstan as well as the Chinese heartland. As presented before, these impacts can be both positive and negative and in this chapter I will focus on a couple of topics to answer the questions presented in the beginning of this paper. How does the oil trade, and resulting relationship, between Kazakhstan and China (Xinjiang) indirectly affect the water resources in the area? And what effects will the emerging SNG technology in Xinjiang have on the relations between the two countries and their respective water resources?

The oil trade between Kazakhstan and China helps develop Xinjiang, and the development of Xinjiang strengthens the relationship between Kazakhstan and China. As presented by Clarke (2011) this trade and deepened relationship between the two states plays a significant role in stabilizing and developing the autonomous region of Xinjiang. Growing prosperity and stability results in, and feeds off, a large-scale immigration from Eastern China as observed by Howell and Fan (2011). These factors increase the consumption of food, energy, clothing and other commodities that heavily rely on local water resources. Zuo et al. (2013) argue that the economic growth of Xinjiang is especially tied to water consumption.

China is at present Kazakhstan's most valuable partner, both economically and politically. Kazakhstan is heavily reliant on the revenue from its oil-trade with China. The similarities in their political systems make China a model as well as guarantor for the sitting government of Kazakhstan. According to a report by UNDP (2004) Chinese diversion of water from the Ili basin is recognized as a matter of national security in Kazakhstan but there is no legal framework to fall back on. Thus, I argue that Kazakhstan's only means by which to tackle the issue at present would be vociferous opposition. The relationship between the two states however appears to tone down the criticism that Kazakhstan presents to China on the matter, as has previously been presented by Allouche (2007). Consequently, I conclude that importing oil from Kazakhstan to China and the development of ties between the two states leads to a decrease in available water in transboundary watersheds on both sides of the border.

The Ili River has seen diminished flows over recent years and there are fears of the river laying bear during parts of the year, as previously voiced by Stone (2012). Huo et al. (2013) argues that the SNG production is a water intense method of energy production. According to the study the SNG facilities are being developed in the Ili region of Xinjiang due to the combination of a secure water source, the Ili River. However, I believe that there will be an additional pressure on water resources as the development of SNG production indirectly will affect the use of water through its generation of jobs, wealth, immigration and eventually consumption in the region. Consequently, I argue that there will be a measurable difference in the discharge of the Ili due to the SNG development. Together with the already diminishing discharge this will affect the environment, livelihoods and economy of the Ili basin.

Pollution in the form of spillwater from the SNG production facilities will likewise put pressure on the Ili system. Huo et al. (2013) argue that the water remaining in the Ili can become harmful to use, as has happened in many other rivers in Central Asia. Lake Balkhash, the terminus of the Ili, has seen a deterioration of its ecosystem due to the utilization of the Ili River according to studies by Allouche (2007) and the UNDP (2004). These studies argue that as the lake is emptied only through evaporation it means that lower inflows will mean drastically sinking water levels as evaporation levels remain on the same level regardless of the lessened inflow. Allouche (2007) fears that Lake Balkhash is facing the same fate as its neighbour, the Aral Sea. I argue that these studies prove the fragility of the Ili-Balkhash system and that further pressure brought on by SNG production will have a deteriorating effect on Lake Balkhash. The lessening inflow and rising pollution levels will lead to larger concentrations of pollutants in the Lake, however I will not venture to evaluate the scale of this development.

The production of SNG will however have effects far beyond the impact it will have on water resources. China is in great need of alleviation of its air pollution problems that are a matter of public health, especially in its eastern heartland. Li et al. (2014) argue that SNG has the potential to alleviate these issues as the primary source of air pollution from energy production is moved away from the affected areas. On the other hand Ding et al. (2013) & Chandel and Williams (2009) present that the global impact in the form of greenhouse gases is negative as a whole as the production and use of SNG produces more gases compared with the traditional use of coal as a source of energy. From these

studies I conclude that the local environmental problems of eastern China would be alleviated by the development of SNG production, while the global environment as well as the environment in Xinjiang and Kazakhstan would suffer from it.

China is aiming to be more self-sufficient in its energy production and SNG as a new source of energy will lessen the nation's dependence on imported fuels as mentioned by Yang (2015). I argue that there is a large possibility that this will significantly lessen the import of oil and gas from Kazakhstan. This in turn would lessen Kazakhstan's dependency on Chinese good will. I conclude that if taken in terms of water resources it can give Kazakhstan greater reason to oppose the excessive use and pollution of their shared water resources.

## 6 Conclusion

In this article I chose to investigate two parallel relationships, that between the politics of energy and water as well as that between the states of Kazakhstan and China. To understand these issues further I answered the two following questions.

I examined how the oil trade, and resulting relationship, between Kazakhstan and China (Xinjiang) indirectly affect the water resources in the area. Through reviewing available material I conclude that importing oil from Kazakhstan to China fuels population increase, immigration and consumption. This development increase both water use and pollution of the watersheds in the studied Ili-Balkhash watershed, as well as wider in the region. The trade also serves as the main grounds for a relationship between the two states where the Kazakh government does precious little to pressure the Chinese government into addressing the issue. There is a lack of regulatory framework to address this issue on legal grounds.

In this study I also reviewed what effects the emerging SNG technology in Xinjiang will have on the relations between the two countries and their respective water resources. I conclude that the planned SNG production in Xinjiang will help develop Xinjiang further and so strengthen the harmful impact of development on the trans-boundary watersheds. In addition, the process of producing SNG from coal is very water intense and will further deplete the available water resources, mainly the Ili-Balkhash system. The pollution of the production process combined with the diminishing water levels will raise the concentration of pollutants in the Ili-Balkhash system.

The production of SNG will strengthen the Chinese self-sufficiency of energy and therefore lessen its dependence of energy imports, likely also from Kazakhstan. I argue that this has the potential of worsening the relations between Kazakhstan and China due to water disputes paired with lesser economic relations. Kazakhstan may become more vociferous in its protests against the Chinese use of the trans-boundary watersheds but without legal framework there is no guarantee that there will be a reaction to these cries.

Due to the findings above I conclude that the Ili-Balkhash system is facing hard times. The water depletion and pollution can make the river unusable for at least parts of the year, which heavily will alter the way of life in Eastern Kazakhstan. This can potentially

destabilize the country. Lake Balkhash is already facing the same fate as its better known cousin, the Aral Sea. With lesser inflows paired with higher concentrations of pollutants it is likely that the lake will become even more polluted than at present, and slowly disappear.

I argue that there needs to be a regulatory framework in place governing the use of the trans-boundary waters between China and Kazakhstan to stop this development and to address future issues. For this to become reality Kazakhstan will have to raise its voice more than it has so far. As the SNG development has the potential of lessening the two states' dependency on each other it also opens a window for discussion. What the Ili-Balkhash system needs is an open discussion between the two states as well as the local population and industries to put a framework for water-use in place. Ironically this strengthening of legal ties could be achieved by the weakening of economic ties.



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